ALPHA BIOFUELS PTE LTD
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Business Reg: 200807179D

ALPHA biofuels
energy from waste

Comparison of Alpha Biodiesel with EN 14214:2003 Standard

Specification	Unit	EN 14214:2003 Standard	Alpha Biodiesel Test Results	Remarks
Ester Content	%(m/m)	> 96.5	99.2	Alpha Biodiesel exceeds the minimum requirement. Our good production technique gives high reaction conversion.
Density @ 15^{O}C	g/cm^{3}	0.86 – 0.90	0.8835	Alpha Biodiesel is within the specified range. Fuel consumption is not adversely affected after changing to biodiesel from mineral diesel
Viscosity @ 40^{O}C	mm^{2}/s	3.5 – 5.0	4.364	Alpha Biodiesel is within the specified range. The risk of choked injectors is low.
Flashpoint	^{O}C	> 120	170.0	Alpha Biodiesel exceeds the minimum requirement. It is safe for storage and does not pose as a fire hazard
Sulphur	mg/kg	< 10	3.1	Alpha Biodiesel is within the limit. There is low engine wear and can prolong the life of the catalytic converter
Cetane Number		> 51	58.0	Alpha Biodiesel exceeds the minimum requirement. High ignition quality and good combustion
Water Content	mg/kg	< 500	460	Alpha Biodiesel is within the limit. Corrosion of components in the fuel injection system is low. Storage life is long.

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Copper Corrosion Strip test (50^{O}C/3hrs)		1	1	Alpha Biodiesel matches the specifications. It will not corrode engine parts
Acid Value	mg KOH/g	< 0.5	0.13	Alpha Biodiesel is within the limit. Corrosion of fuel injector components and engine deposits are low.
Iodine Value	mg iodine/g	< 120	117	Alpha Biodiesel is within the limit. There is low injector fouling and good storage stability
Methanol	%(m/m)	< 0.20	0.03	Alpha Biodiesel is within the limit. Corrosion of aluminium and zinc components are low.
Monoglycerides	%(m/m)	< 0.8	0.779	Alpha Biodiesel is within the limit. Deposit formation on injectors and combustion chamber is low.
Diglycerides	%(m/m)	< 0.2	0.102	
Triglycerides	%(m/m)	< 0.2	0.093	
Free Glycerol	%(m/m)	< 0.02	0.001	
Total Glycerol	%(m/m)	< 0.25	0.224	
Group I Metal (Na, K)	mg/kg	< 5	< 1	Alpha Biodiesel is within the limit. Ash levels in engine is low.

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Detailed Explanation of Tests

Ester Content (EN 14103)
Normally measured using gas chromatography and is a test for reaction conversion from oil to ester.

Density (EN ISO 3675/12185)
Biodiesel generally have higher densities than mineral diesel (EN 590 which specifies a density of 820-845 kg/m3 at 15°C). Density can affect fuel consumption as this is measured volumetrically.

Viscosity (EN ISO 3104/3105, D445)
Biodiesel still has higher viscosity than mineral diesel (3.50-5.00 mm2/s at 40°C versus 2.00-4.50 mm2/s). Viscosity decreases with unsaturation but increases due to contamination by mono-glycerides, di-glycerides and tri-glycerides. Higher viscosities are associated with poor atomization and incomplete combustion and can lead to coked injectors.

Flash Point (ISO 3679, IP 523/524, D93)
Pure rapeseed methyl ester has a flash point value of up to 170°C. This tests identifies other residual components within the fuel which are combustible. This is especially true of methanol which is a particular hazard due to its invisible flame.

Sulphur Content (EN ISO 20846/20884, D5453)
Sulphur emissions are harmful to humans. High sulphur fuels are associated with increased engine wear a reduction in the life of the catalytic converter. Biodiesel derived from pure rapeseed or canola oil will contain virtually no Sulphur, however biodiesels derived from oils which may include animal tallow may contain significant quantities.

Cetane Number (EN ISO 5165, D613)
This is a measure of ignition quality and combustion. This is one of the major reason that biodiesel is better for diesel engines than straight vegetable oil. Biodiesel fuels with low cetane numbers show an increase in emissions due to incomplete combustion. Oils such as palm and animal tallow produce fuels with higher (and better) cetane numbers.

Water Content (EN ISO 12937)
This is one of the most critical factors in biodiesel production and storage. Because biodiesel is hygroscopic it can attract water while stored, and over time can fall out of specification. At around 1500 ppm, water will tend to drop out of the biodiesel fuel. Free water promotes biological growth and can lead to a reverse reaction (hydrolysis) where the biodiesel esters revert back into free fatty acids. Water will also cause corrosion of components in the fuel injection system. Many feel that the EN14214 standard of 500 ppm is too high

and for this reason, the German DIN V 51606 requires the water content to below 300 ppm.

Copper Strip Corrosion (EN ISO 2160, D130)
This is a measure of corrosion to copper, zinc and bronze parts of an engine. A polished metallic strip is heated at 50°C for 3 hours, washed and compared to standards. Corrosion is likely to be caused by free acids or sulfur compounds.

Acid Value (EN 14104, D664)
The acid value is a measurement of the mineral acids and free fatty acids contained in biodiesel. It is the amount of KOH (in mg) required to neutralize 1g of biodiesel. High acidity biodiesels are associated with corrosion of fuel injector components and increased engine deposits.

Iodine Value (EN 14111)
Iodine number is a measure of total unsaturation within the vegetable oil and/or biodiesel. It is expressed as the number of gms of iodine required to replaced all the double bonds within a 100g of sample. High iodine values lead to polymerization of fuels, injector fouling and poor storage stability. The iodine number of the biodiesel is directly linked to the iodine number of the feedstock oil used to make the biodiesel.

Methanol Content (EN 14110)
A high methanol content poses additional safety risks due to the very low flash point of methanol. Methanol is also associated with a reduction in the cetane number of the fuel, and corrosion of aluminium and zinc components in the fuel injection system. Methanol must be removed from the biodiesel either by washing or distillation.

Glycerides (EN 14105, EN 14106, D6584)
In the EN 14214 standard there is a limit on the mono-glycerides, di-glycerides, and tri-glycerides of no more than 0.80%, 0.20% and 0.20% respectively. The total glycerol measure is the sum of the bound and free glycerol and must not exceed 0.25%. Failure of any of these parameters indicates a low ester conversion, and a biodiesel fuel which will cause deposit formation on both the injectors and within the combustion chamber.

Group I Metals
Sodium and Potassium are limited to a combined 5 ppm and result from the addition of catalyst during reaction processing. These must be removed through the wash process otherwise they are a contributory factor in high ash levels in the engine.

Information taken from: www.biodiesel-insider.com